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A LONG RECORD OF MICROSCOPICAL EXAMINATIONS

By George C. Whipple[1]

The spectacular publicity given by the daily press to the recent occurrence of Synura in the water supply of New York City has tended to renew a somewhat flagging interest in the general subject of microscopic organisms in water. It may be worth while, therefore, to call attention to the long record of microscopical examinations of the water supply of Boston which were begun by the writer in 1889 and which are being continued without change of method in the laboratory of the Metropolitan District Commission. Some day these data, together with those begun a few years later in the Mount Prospect Laboratory of Brooklyn and perhaps others, ought to be assembled and studied critically in order to search out correlations between the growths of the organisms and certain climatic, physical and chemical factors which may help to explain the reasons for their erratic occurrence. As examples of these long records a few diagrams are here presented.

Figure 1 shows the microscopic organisms in Wachusett Reservoir from 1898 to 1920. The data represent weekly tests of surface samples. They are plotted by months, the median for each month, as well as the maximum and minimum, being shown. It will be remembered that the top soil was removed from the site of this reservoir. Although the storage of water began in 1898, the reservoir did not fill until 1905, since which date there has never been any great depletion. During the filling period, there were few organisms in the Wachusett water. Its color at this time was quite high, and the conditions of light were not favorable to the development of plant life. Since 1905, there have been fairly regular growths of algae, and at times some rather heavy growths. Asterionella has been the most troublesome, but other diatoms and even the blue-green algae have been present in numbers sufficient to cause

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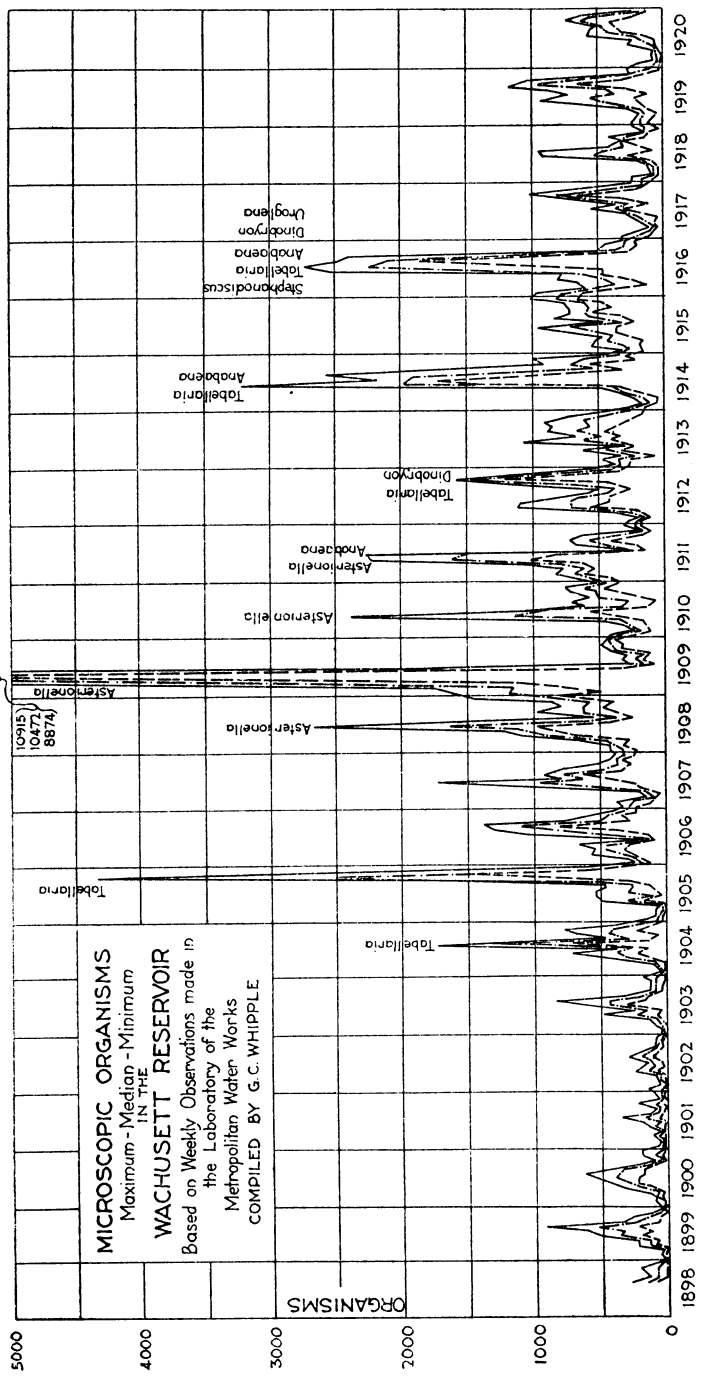

MICROSCOPIC ORGANISMS
Maximum - Median - Minimum
IN THE
WACHUSETT RESERVOIR
Based on Weekly Observations made in the Laboratory of the Metropolitan Water Works
COMPILED BY G.C. WHIPPLE
ORGANISMS
5000
4000
3000
2000
1000
0
1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920
Tabellaria
Asterionella
10915
10477
8874
Tabellaria
Asterionella
Asterionella
Tabellaria
Anabaena
Tabellaria
Dinobryon
Tabellaria
Anabaena
Stephanodiscus
Tabellaria
Anabaena
Dinobryon
Uroglena

Fig. 1

noticeable odors. If the data for the ten recent years (1909–1919) are plotted on logarithmic probability paper, as in figure 2, it will be seen that they fall on a straight line or nearly so. The median

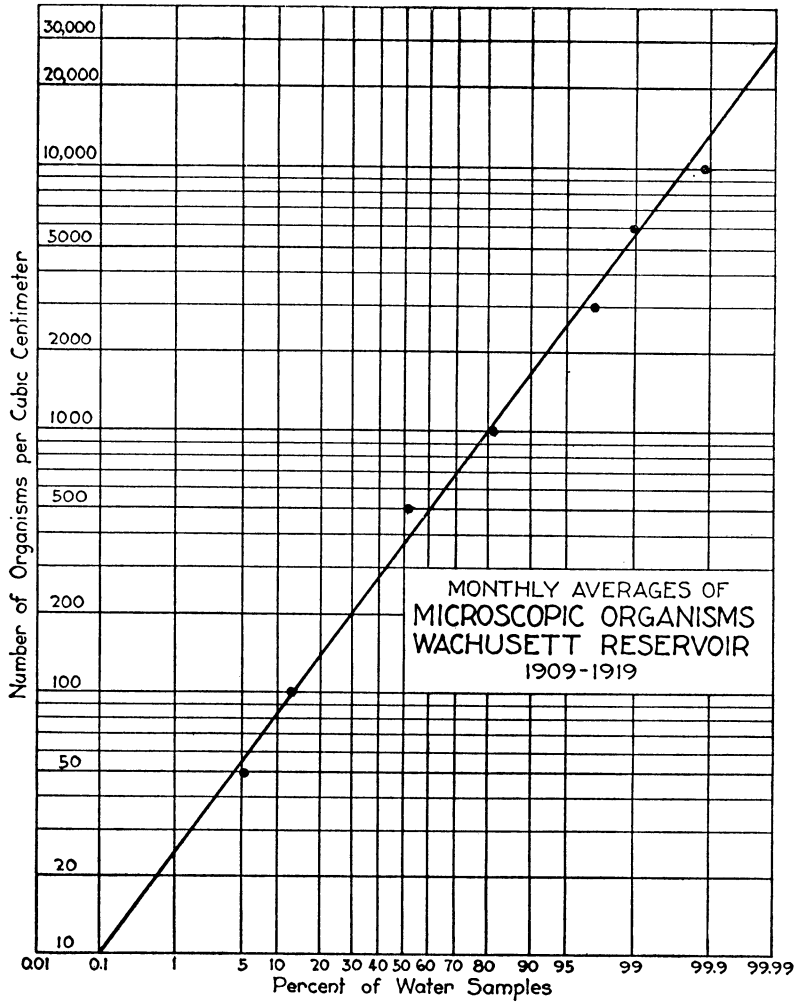


FIG. 2

figure is seen to be about 350 standard units of organisms per cubic centimeter—a fairly large figure but not enough to be noticeable, considering the genera present. About ten per cent of the examina-

tions showed more than 1500 and one per cent of them showed more than 5000 units per cubic centimeter. It is evident that the soil stripping of the reservoir site did not entirely prevent the growth of algae.

Figure 3 shows the microscopic organisms in the Sudbury Reservoir, through which the Wachusett water passes on its way to the city. Some of the high points on the curve are due to growths which began in the Wachusett Reservoir, but the Sudbury Reservoir also has its own seasonally recurring organisms.

Figure 4 shows the results of microscopical examination of Lake Cochituate water from 1892 to 1920. This is a natural lake. It was used regularly from 1848 to about 1909, since which year it has been held as a reserve supply drawn upon infrequently. Lake Cochituate has always been famous for its algae growths, but since it became a reserve supply the growths have been heavier than before, and whenever the lake has been drawn upon the characteristic odors of the organisms usually cause complaint in the city.

Ultimately these water supplies will have to be filtered.

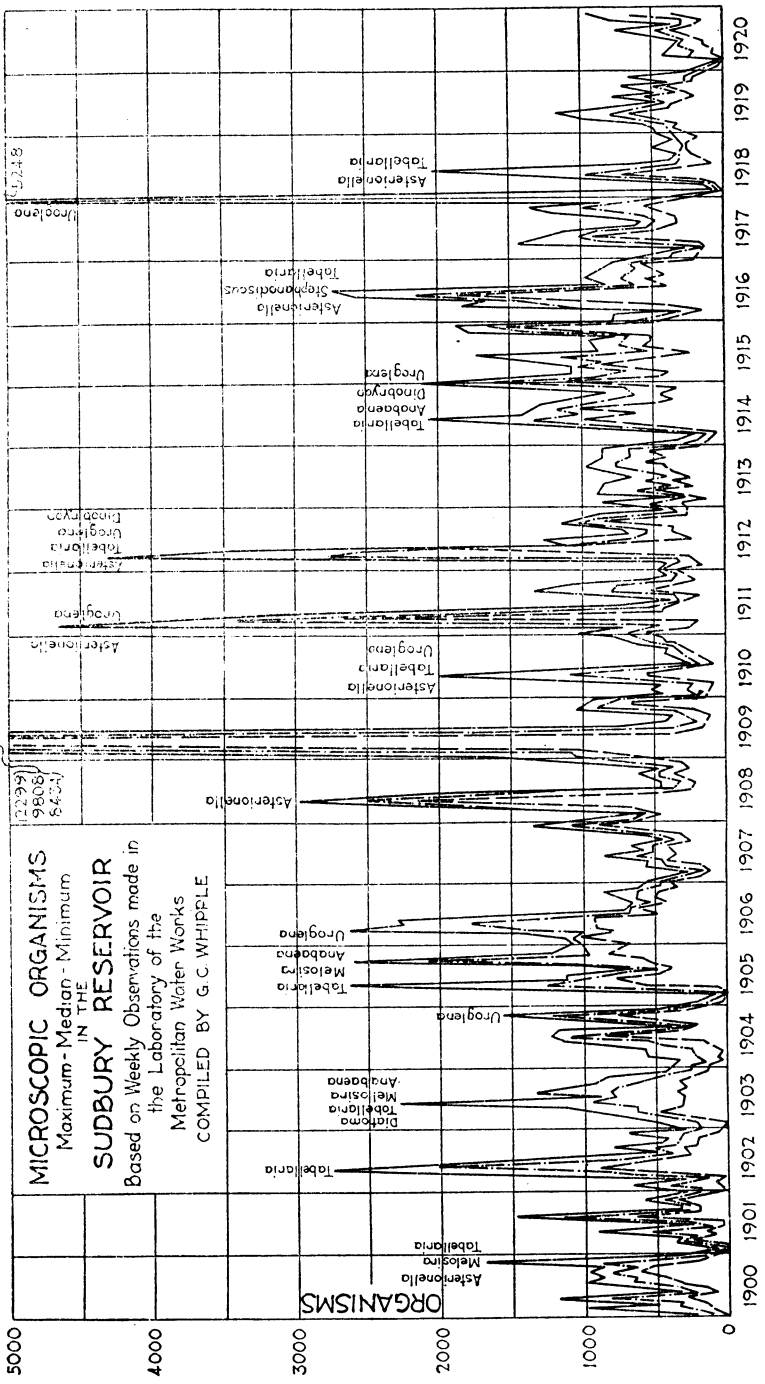

MICROSCOPIC ORGANISMS
Maximum-Median-Minimum
IN THE
SUDBURY RESERVOIR
Based on Weekly Observations made in the Laboratory of the Metropolitan Water Works
COMPILED BY G.C. WHIPPLE
ORGANISMS
5000
4000
3000
2000
1000
0
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
Asterionella
Melosira
Tabellaria
Tabellaria
Diatoma
Tabellaria
Melosira
Anabaena
Uroglena
Tabellaria
Melosira
Anabaena
Uroglena
Asterionella
Asterionella
Tabellaria
Uroglena
Asterionella
Uroglena
Asterionella
Tabellaria
Uroglena
Dinobryon
Tabellaria
Anabaena
Dinobryon
Uroglena
Asterionella
Stephanodiscus
Tabellaria
Uroglena
Asterionella
Tabellaria

FIG. 3

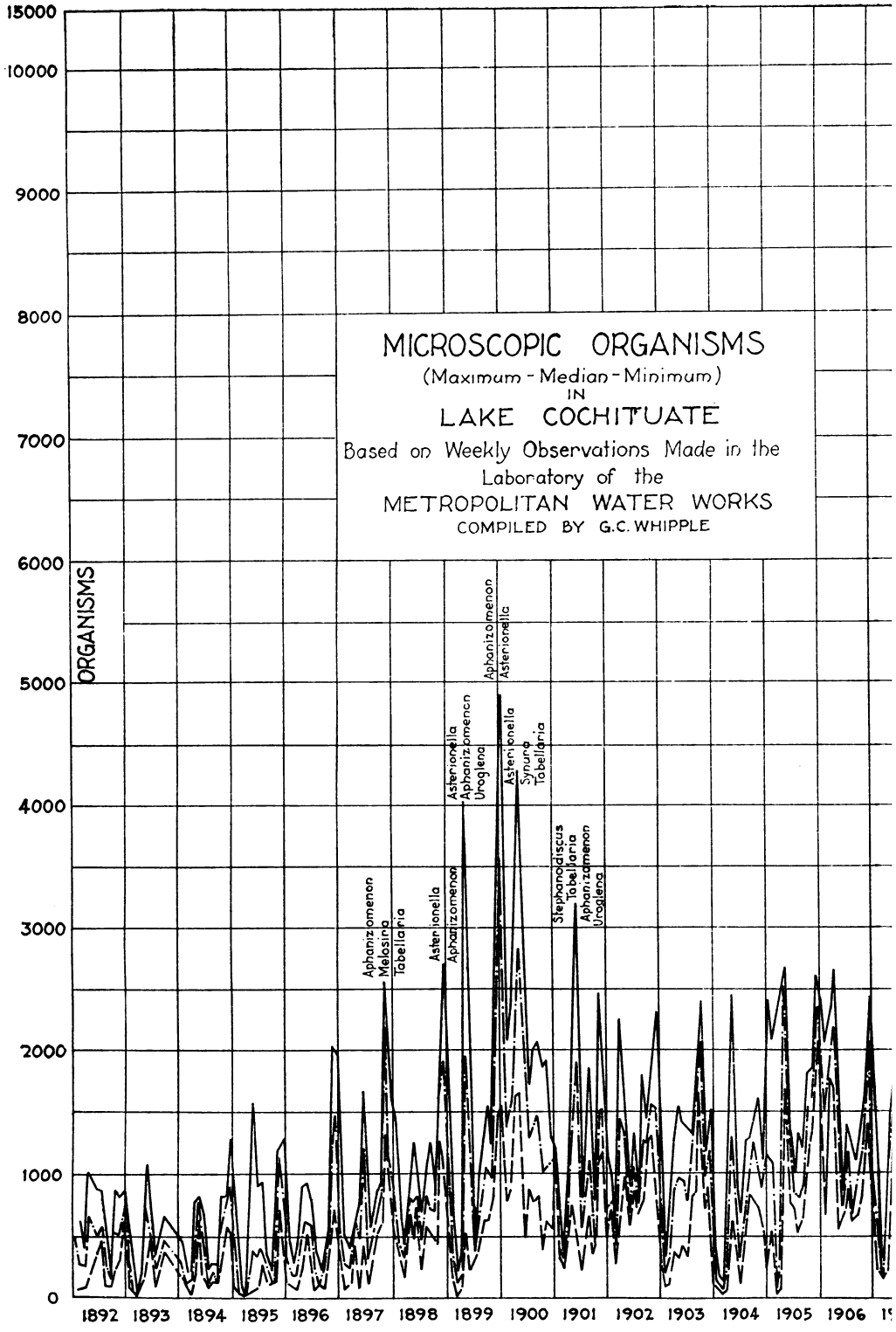

MICROSCOPIC ORGANISMS
(Maximum - Median - Minimum)
IN
LAKE COCHITUATE
Based on Weekly Observations Made in the
Laboratory of the
METROPOLITAN WATER WORKS
COMPILED BY G.C. WHIPPLE
ORGANISMS
15000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
Aphanizomenon
Melosira
Tabellaria
Asterionella
Aphanizomenon
Asterionella
Aphanizomenon
Uroglena
Aphanizomenon
Asterionella
Asterionella
Synura
Tabellaria
Stephanodiscus
Tabellaria
Aphanizomenon
Uroglena

FIG. 4

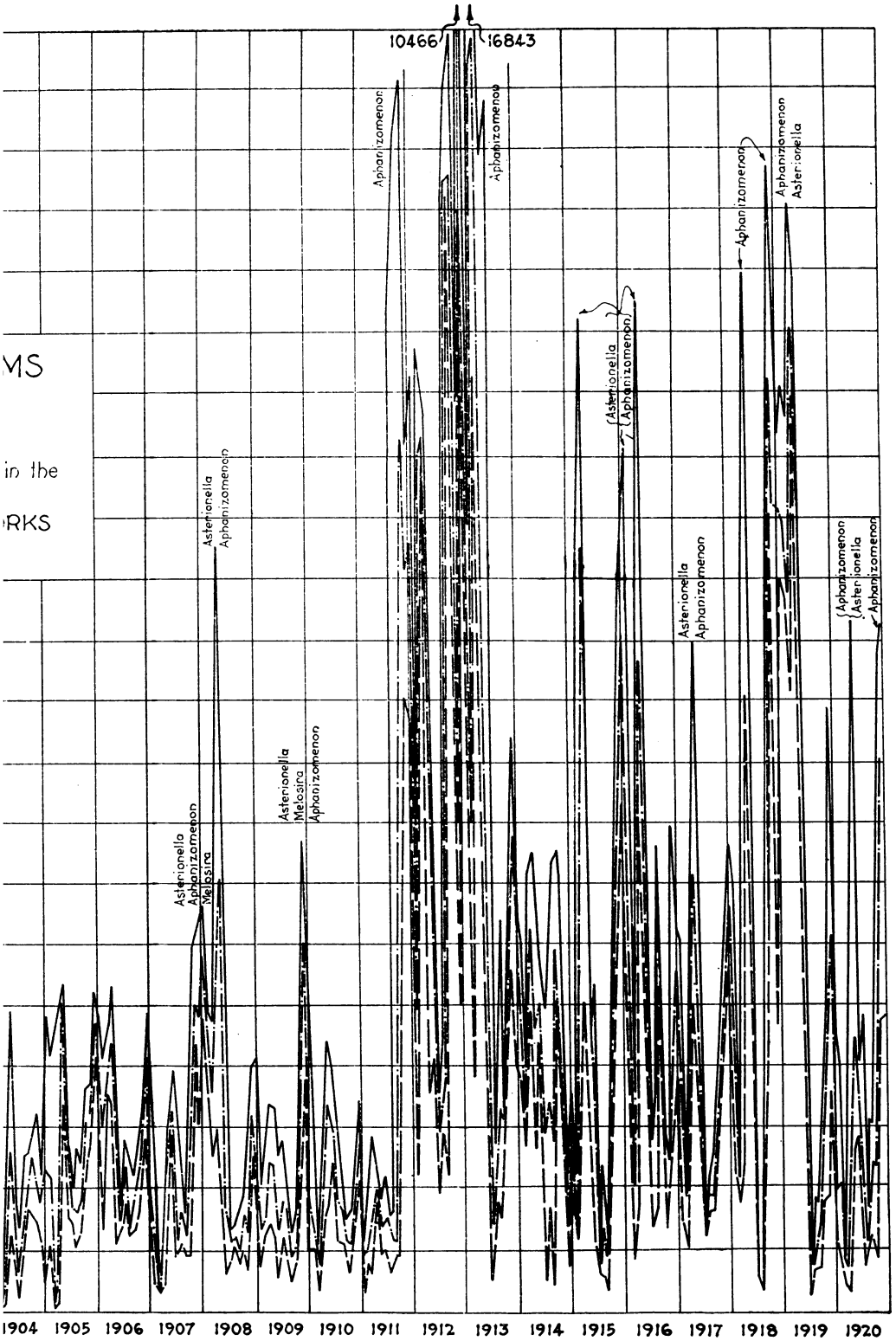

10466
16843
Aphanizomenon
Aphanizomenon
Asterionella
Aphanizomenon
Asterionella
Melosira
Aphanizomenon
Asterionella
Melosira
Aphanizomenon
(Asterionella
Aphanizomenon)
Asterionella
Aphanizomenon
Aphanizomenon
Aphanizomenon
Asterionella
(Aphanizomenon
Asterionella
Aphanizomenon
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920

FIG. 4

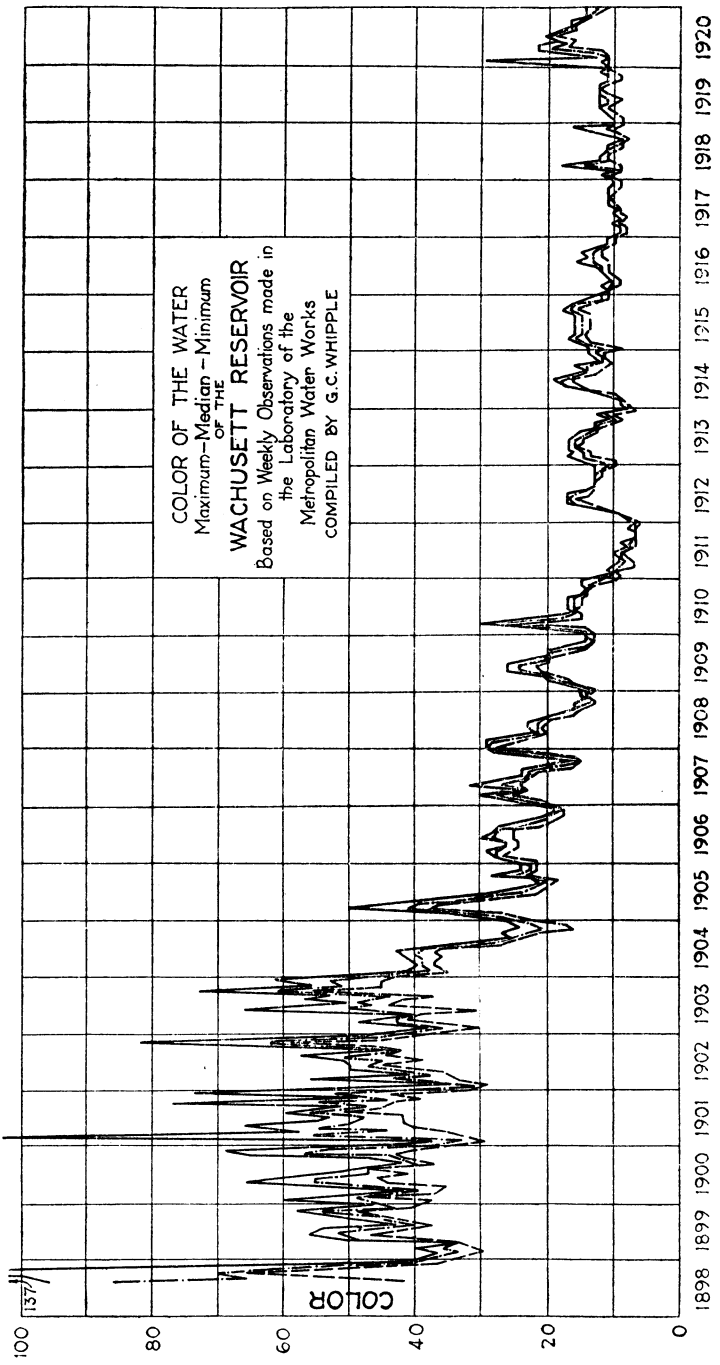

COLOR OF THE WATER
Maximum-Median-Minimum
OF THE
WACHUSETT RESERVOIR
Based on Weekly Observations made in the Laboratory of the Metropolitan Water Works
COMPILED BY G.C. WHIPPLE
COLOR
137
100
80
60
40
20
0
1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920

FIG. 5